Interventional Neuroradiology 10 (Suppl 1): 143-146, 2004

The Choice of Treatment Method for Unruptured Cerebral Aneurysm

Investigation from Clinical Outcome, Angiographical Result, Duration of Hospital Stay, and Cost for Treatment

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Key words: direct surgery, GDC embolization, unruptured cerebral aneurysm, cost, hospital stay

Summary

To compare complications, anigographical results, duration of postoperative hospital stay and cost for treatment of surgical clipping and coil embolization in the treatment of unruptured cerebral aneurysm.

One hundred and nine non-giant saccular aneurysms in 90 patients were treated by either endovascular treatment (E group) or direct surgery (S group) in our Neurosurgical Department between April 1996 and April 2002. The complications and angiographical results were reviewed. The duration of postoperative hospital stay and cost for the treatment were calculated from bills for health insurance for 38 operations and 12 embolizations in 47 patients whose aim of hospitalization was only treatment for their unruptured aneurysm.

Neck clipping was performed for 89 aneurysms (S group), wrapping for four (S group), embolization using Guglielmi's detachable coils (GDCs) for 15 (E group), and failed embolization followed by clipping for one (E group). The postoperative temporary deficit (disappeared within one month) and permanent deficit was seen in five cases (6.7%) and in three cases (morbidity: 4.0%) of S group, and in one case (6.7%) and none (morbidity; 0%) of E group, respectively. No death was seen in both group (mortality; 0% in both group). The rate of angiographical complete occlusion of the aneurysm was significantly higher in S group (P = 0.015, 88% in S group vs 50% in E group). The postoperative hospital stay was significantly shorter in E group (P=0.000013, mean days: 17.1 in S group vs 6.3 in E group), but cost for treatment was rather cheep in S group (N.S., mean cost: 1684329 yen in S group vs. 2259011 in E group).

This retrospective study suggested that surgical treatment may be less expensive treatment with higher rate of postoperative angiographical complete occlusion than coil embolization, and treatment-related complication rate was similar in both treatment.

Introduction

Although the coil embolization is accepted as the first choice of treatment for surgically difficult aneurysms such as posterior circulation aneurysms [1,2], but it is still under investigation whether Guglielmi's detachable coil (GDC) embolization would become a first choice of treatment for such unruptured aneurysms as are suitable for both GDC embolization and direct surgery [3,4,5].

In this paper, we made a retrospective chart review on unruptred cerebral aneurysms treated by either coil embolization or direct surgery in our Neurosurgical Departmenrt for past 6 years, and compared complications, angio-

graphical results, postoperative hospital stay and cost for treatment in surgical clipping and coil embolization. The selection of treatment for unruptured cerebral aneurysms was discussed.

Clinical Material and Methods (table)

Patient Population

The 109 aneurysms in 90 patients were treated by either direct surgery or endovascular treatment using GDCs. Suspected less difficult treatment method, GDC embolization or direct surgery, that was judged by at least 2 neurosurgeon, was performed for each aneurysm. When the aneurysm was judged to be suitable fo both treatment, we chose the surgical treatment.

Complications and Angiographical Results

Complications were defined as temporary when the deficit resolved within one month and return to the base line condition, or permanent when present after one month. Obliteration of the aneurysm was assessed by angiograms of different four projections. The complications and the angiographical assessment was judged by three neurosurgeons and one interventional neuroradiologist.

Cost of Treatment and Postoperative Hospital Stay

The cost of treatment was defined as sum of charge of hospitalization from the day of operation or embolization to the day of discharge, and calculated from bill for health insurance. This included the cost of operation or embolization, material for operation or embolization, imaging, ward and ICU bed, drugs, laboratory examination, and rehabilitation.

Postoperative hospital stay was defined as duration from day of operation or embolization to day of discharge. For precise comparisons, cost of treatment and postoperative hospital stay were investigated on 38 operations and embolizations in 47 patients whose aim of hospitalization was only treatment for their unruptured cerebral aneurysm.

Statistical Analysis

Statistical analysis was performed using commercially available statistical software (Microsoft Exel 98). Mann-Whittney U test or unpaired t-test was used when appropriate. Statistical significant was set at a probability value less than 0.05.

Result (table)

Clinical Outcome

In surgery group, temporary deficits were seen in five patients (6.7%); three patients of transient aphasia, one transient quadrantanopsia, and one memory disturbance. The permanent deficits were seen in three patients (4.0%); two patients of hemiparesis, and one dementia. No death was seen in surgery group. The other 67 patients fully recovered to their base-line neurological condition within 12 hours after operation. In GDC group, one patient of temporary deficit (6.7%) was seen; intraoperative rupture. No permanent deficit nor death was seen in this group. Therefore, the temporary/permanent morbidity and mortality rate in surgery group was rather higher (10.7%) than that in GDC group (6.7%), but the difference was not statistical significant.

Aneurysm Size and Angiographical Results

The mean size of the aneurysms was rather larger in GDC group (surgical group; 7.9 ± 4.6 mm, GDC group; 7.5 ± 3.7 mm), but there was no statistical significant. All aneurysms treated by GDC embolization had either dome to neck ratio of more than 2 or neck size of less than 4 mm. This suggested that all aneurysms treated by GDC embolization were geometrically suitable for GDC embolization[6,7].

Postoperative angiography was performed for all aneurysms within two weeks after the operation. In surgical group, complete obliteration was seen in 82 aneurysms (88%), incomplete obliteration in 11 aneurysms (12%). In GDC group, eight aneurysms (50%) judged as complete occlusion, the other eight as incomplete occlusion (six neck remnant, one body filling, and one failure). The rate of complete obliteration of the aneurysm immediately after treatment was significant higher in surgery group (P=0.015).

Cost for Treatment and Postoperative Hospital Stay

The postoperative hospital stay was significantly longer (P=0.000013) in surgical treat-

Table **Comparison of Direct Surgery and GDC Embolization**

	Direct Surgery	GDC Embolization	
• **Patients**	75	15	
age	63 (36-78)	59 (41-78)	
sex (F:M)	47 : 28	12 : 3	
• **Aneurysms**	93	16	
cavernous ICA	0	1	
IC ophthalmic	0	8	
supraclinoid IC	28	0	
AcoA, ACA	15	1	
MCA	47	0	
vertebrobasilar	3	6	
size (mean ± SD)	7.9 ± 4.6	7.5 ± 3.7	N.S.*
• **Treatment**	n = 93	n = 16	
	Clipping: 89	intraaneurysm occlusion: 16	
	Wrapping: 4		
• **Clinical outcome**	n = 75	n = 15	N.S.**
temporary deficit	5 (6.7%)	1 (6.7%)	
permanent deficit	3 (4.0%)	0 (0%)	
death	0 (0%)	0 (0%)	
• **Angiographical result**	n = 93	n = 16	P=0.015**
complete occlusion	82 (88%)	8 (50%)	
incomplete occlusion	11 (12%)	8 (50%)	
• **Postoperative hospital stay**	n = 38	n = 12	P=0.000013**
(days)	17.1 (9-80)	6.3 (2-32)	
• **Cost for treatment** (yen)	n = 38	n = 12	N.S.**
	1684329 (1006040-4731780)	2259011 (1487700-4040590)	

**unpaired t-test, **Mann-Whittney U test*

ment (9-80 days, mean: 17.1) than in GDC embolization (2-23 days, mean: 6.3).

The cost for treatment was rather higher in GDC treatment (mean; 2259011 yen, 1487700-4040590) than in surgical treatment (mean; 1684329 yen, 1006040-4731780), but the difference was not statistically significant.

Discussion

This study suggested the followings:

1) no significant difference of postoperative morbidity/mortality rate between GDC embolization and direct surgery;

2) significantly higher incidence of incom-

plete aneurysm occlusion immediate after treatment by GDC embolization than by direct surgery;

3) significantly longer postoperative hospital stay in direct surgery than in GDC embolization;

4) cheaper cost for treatment in direct surgery than in GDC embolization, but no significant different.

Taking it into consideration that each unruptured cerebral aneurysm in this study was thought to be suitable for its actually treated method in terms of aneurysm geometry or its location, these suggestions would lead us to conclude that the direct surgery should be considered first in treatment for unruptured cerebral aneurysm that is suitable for both direct surgery and GDC embolization, because of expected low incidence of incomplete occlusion of the aneurysm and cheep cost. However, as these results should be seen as preliminary, further investigation is needed.

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